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ORIGINAL

FLOOD INSURANCE STUDY

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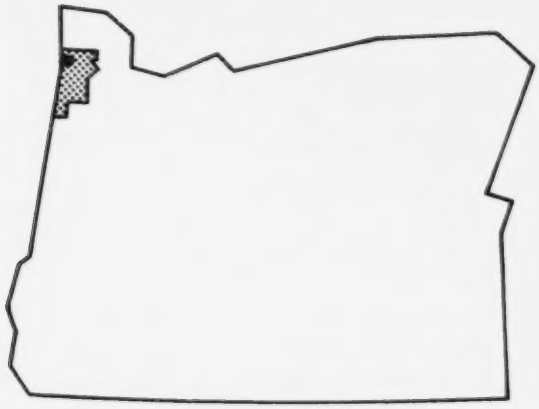
CITY OF NEHALEM, OREGON
TILLAMOOK COUNTY



JUNE 1977

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Federal Emergency Management Agency

COMMUNITY NUMBER - 410200

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FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of Nehalem, Tillamook County, Oregon, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Nehalem to the regular program of flood insurance by the Federal Insurance Administration. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

Information relevant to the study was furnished by the City of Nehalem and the Clatsop-Tillamook Intergovernmental Council.

An initial coordination meeting with local officials and representatives of the Federal Insurance Administration and the State of Oregon was held on July 2, 1975, to identify data sources, establish communication and coordination procedures, and to explain the basic concepts and scope of the study.

A final community coordination meeting to review flooded-area maps and floodway limits was held on October 28, 1976. The local officials and private citizens in attendance at that meeting agreed with results of the study and voiced no protest with the flood insurance data.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers for the Federal Insurance Administration, under Inter-Agency Agreement Nos. IAA-H-16-75 and IAA-H-7-76, Project Order Nos. 16 and 1, respectively. This work, which was completed in August 1976, covered all significant flooding sources affecting the City of Nehalem.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Nehalem, Tillamook County, Oregon. The area of study is shown on the Vicinity Map (Figure 1).

The Nehalem River is the only significant stream passing through the corporate area, and hence is the only one studied in detail. The area studied in detail was chosen with consideration given to all forecasted development and proposed construction through June 1978.

2.2 Community Description

Nehalem, a small retirement community, is located near the mouth of the Nehalem River, in northern Tillamook County on the north coast of Oregon. The city is surrounded by unincorporated areas of Tillamook County and is located approximately 60 miles west of Portland. The community's commercial development is located along Highway 101, the main coastal road which bisects the community. Residential development is located primarily north and west of Highway 101. East of the highway, low-lying river frontage is used for commercial and recreational purposes.

Settlement of the study area began in the late nineteenth century. The local economy was based on dairying and on the rich timber and fishery resources nearby. Nehalem was incorporated in 1912 and included a substantial commercial development to support the local economy (Reference 1).

After incorporation, Nehalem's population fluctuated widely, as did the region's economy, but has stabilized in the last 40 years. In 1940 and 1960 the population was 247 and 233, respectively. The estimated 1974 population was 260 (Reference 2).

The climate consists of cool, relatively dry summers and mild, wet winters. Temperatures are usually moderate, ranging from an average monthly minimum in January of 36.8°F to an average monthly maximum in July of 67.2°F (Reference 3). The average annual precipitation is approximately 93 inches, with 80 percent of the precipitation occurring from October to April (Reference 4).

The Nehalem River forms Nehalem's corporate boundaries on the east. The Nehalem River drains 847 square miles and originates in the Pacific Coast Range. The slope of the Nehalem River in the study area is mild, averaging 0.4 foot per mile. Nehalem's 100-year flood plain is well developed, except for property located between the Nehalem River, U.S. Highway 101, and Seventh Street.

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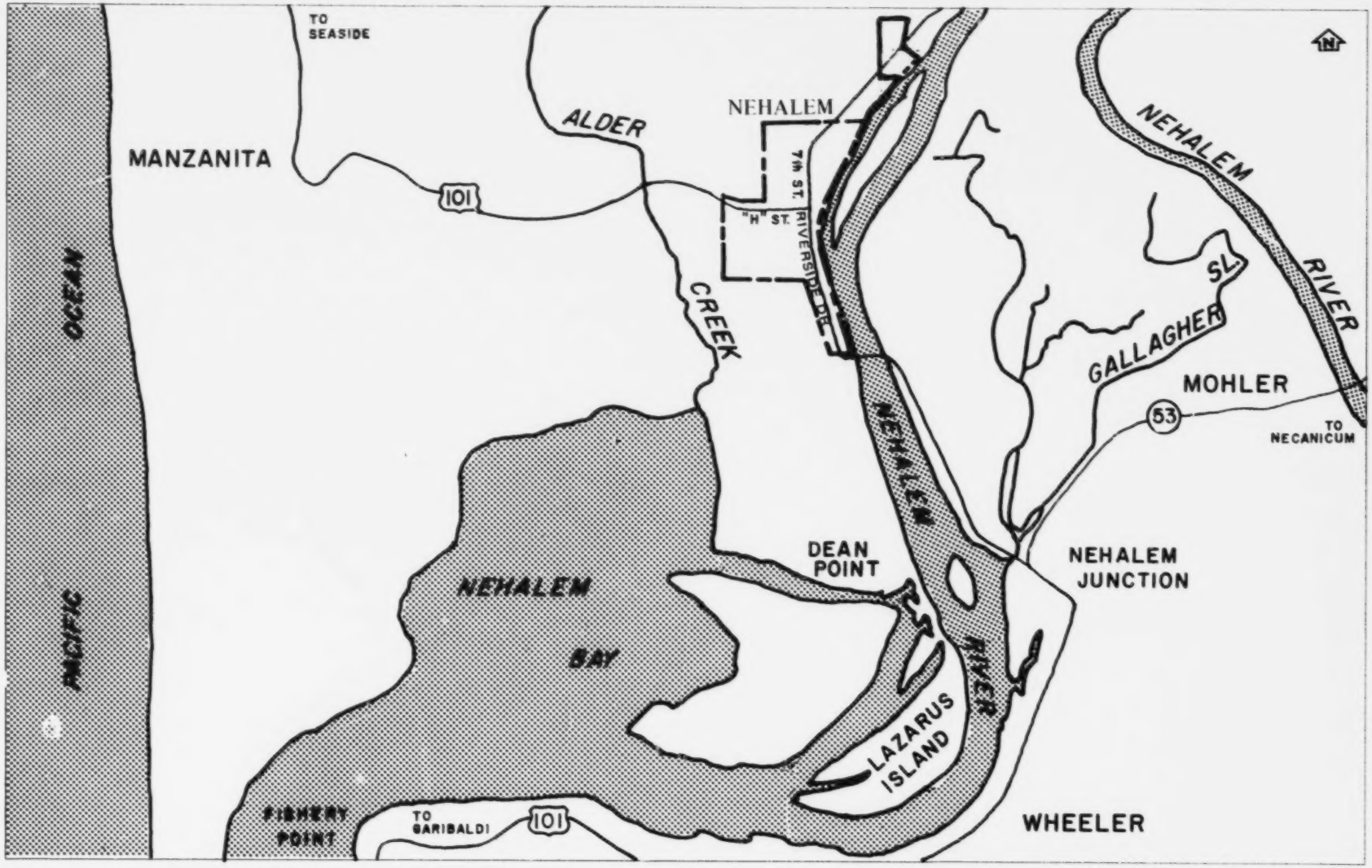

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FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEHALEM, OR
(TILLAMOOK CO.)

APPROXIMATE SCALE
0 2000 4000 6000 8000 FEET

VICINITY MAP

2.3 Principal Flood Problems

Floods in Nehalem are caused by storm-driven high tides from the Pacific Ocean. Storm-driven high tides subject Nehalem to flooding from November through February, when a strong low-pressure system is usually located off the Pacific coast. Although the risk of tidal flooding to Nehalem is severe, flooding from the Nehalem River does not pose a problem unless combined with storm-driven high tides. Flooding from local runoff is a minimal problem in Nehalem, even during severe storms.

Although high-water mark data are not available in Nehalem, interviews with local residents indicate that Nehalem is subjected to flooding from storm-driven high tides several times a year. Although duration of flooding is usually for a short period of time, flood heights can reach a depth of 2 feet on commercial property, located near the banks of the Nehalem River. Most residents are subject only to minimal flooding because of the sharply sloping river banks. Seismic waves, caused by earthquakes called tsunamis, are not considered a major flooding problem in Nehalem due to the offshore geometry of the Oregon coast.

2.4 Flood Protection Measures

There are no projects which provide flood protection for Nehalem. However, a possible grant from the Oregon State Land Conservation and Development Commission may enable the City of Nehalem to finance a comprehensive land use study that includes methods of reducing flood damages in Nehalem by structural means. Residents located in flood prone areas of Nehalem have expressed the desire for a levee system located along the banks of the Nehalem River to reduce frequent flooding in winter from storm-driven high tides.

Flood plain regulations have been adopted by Nehalem to guide new development in the flood plain consistent with the hazard involved. Information provided in this study will be used to determine regulatory flood elevations and to determine where future development is permitted.

3.0 ENGINEERING METHODS

For flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Floods having recurrence intervals of 10, 50, 100, and 500 years have been selected as having special significance for flood plain management and for flood insurance premium rates. The analyses reported here reflect current conditions in the Nehalem River watershed.

3.1 Hydrologic Analyses

Hydrologic analyses of the Nehalem River were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals.

Nehalem River peak discharges were based on stage-frequency curves for the U.S. Geological Survey gaging station at river mile 13.5 near Foss, Oregon (Reference 5), which has been operating continuously since October 1939. Foss is located approximately 13.5 river miles from Nehalem. River gage records were statistically analyzed, using the standard log-Pearson Type III method as outlined by the Water Resources Council (Reference 6). Frequency-discharge, drainage area relationships for the river segment studied are shown in Figure 2.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the Nehalem River were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Water-surface elevations of the selected recurrence intervals were computed using the U.S. Army Corps of Engineers HEC-2 step-backwater computer program (Reference 7). Cross sections for the Nehalem River analysis came from a composite of channel data obtained by the U.S. Army Corps of Engineers field surveys and overbank data taken from contour maps (Reference 8). Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). Nehalem River bridge data were examined to determine their hydraulic effect. However, obstruction to flow caused by debris build-up on bridge piers was not considered because the occurrence and amount of debris cannot be foreseen.

Channel roughness factors (Manning's "n") used in the computer program were 0.022 for the channel and from 0.025 to 0.060 for the overbank areas.

Starting water-surface elevations for the Nehalem River profile computations came from a coastal study for the Tillamook County Flood Insurance Study (Reference 9), using the elevations determined for Nehalem Bay. Because the study area is located in the Nehalem River estuary, the Nehalem River is completely affected by flooding from Nehalem Bay. Results from a coastal study (Reference 9) indicate that a storm surge occurring simultaneously with a high tide from the Pacific Ocean will control flood heights in Nehalem Bay.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), 1947 adjustment. The 1947 adjusted datum supersedes 1929 datum and is 0.62 foot higher in Nehalem. Elevation reference marks used in the study are shown on the map.

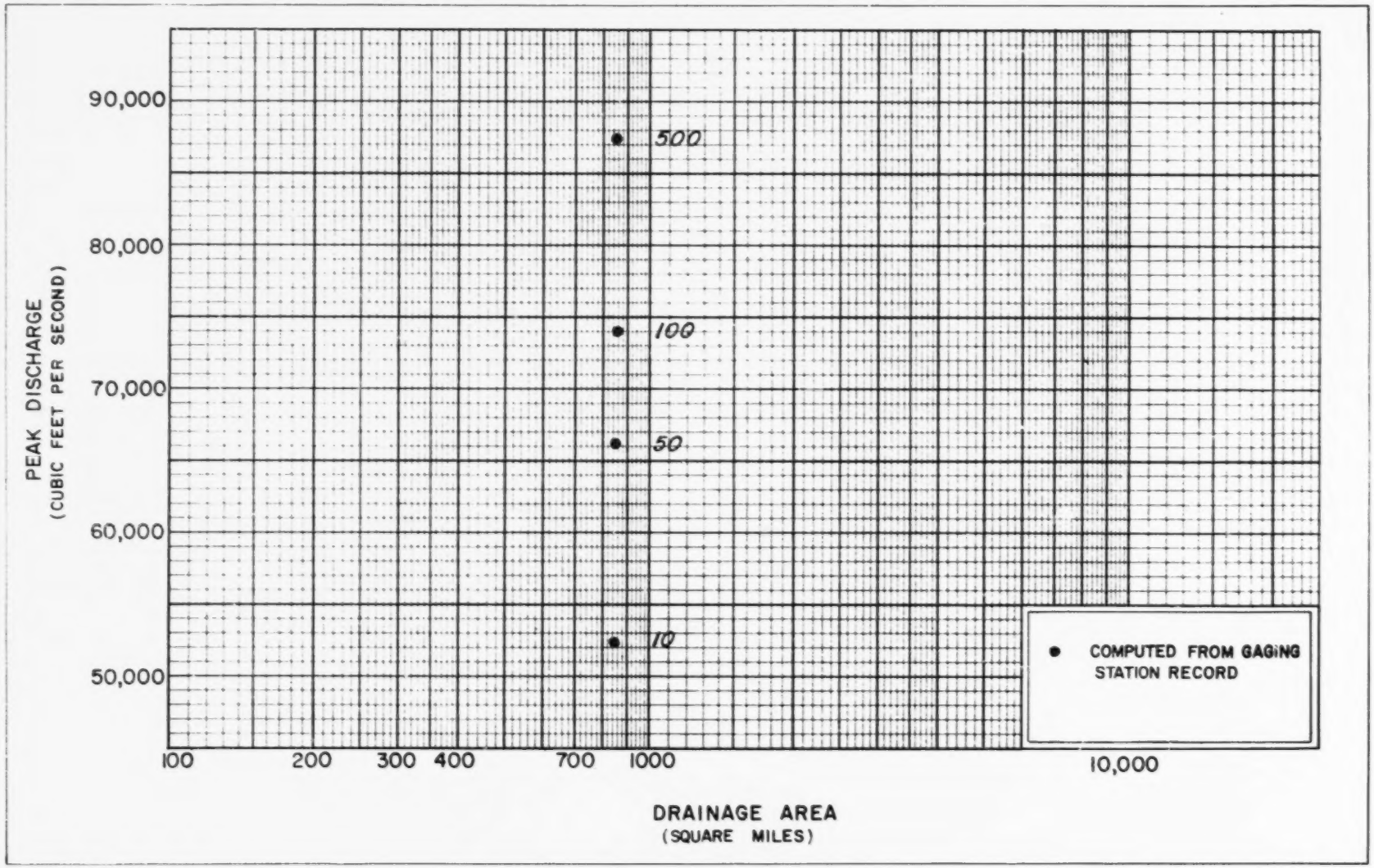

FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEHALEM, OR
(TILLAMOOK CO.)

FREQUENCY DISCHARGE, DRAINAGE AREA CURVES

NEHALEM RIVER

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4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Emergency Management Agency as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the Nehalem River, the boundaries of the 100-year and the 500-year floods have been delineated using flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4800, with a contour interval of 5 feet (Reference 8).

Flood boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year flood boundary corresponds to the boundary of the areas of special flood hazards (Zone A6); and the 500-year flood boundary corresponds to the boundary of areas of moderate flood hazards (Zone B). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. As minimum standards, the Federal Emergency Management Agency limits such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

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The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 3.

A floodway map is not applicable for Nehalem because the floodway boundary coincides with the western river bank which forms the eastern corporate limits of Nehalem; however, Table 1 contains supporting floodway data at each river cross section through the study reach.

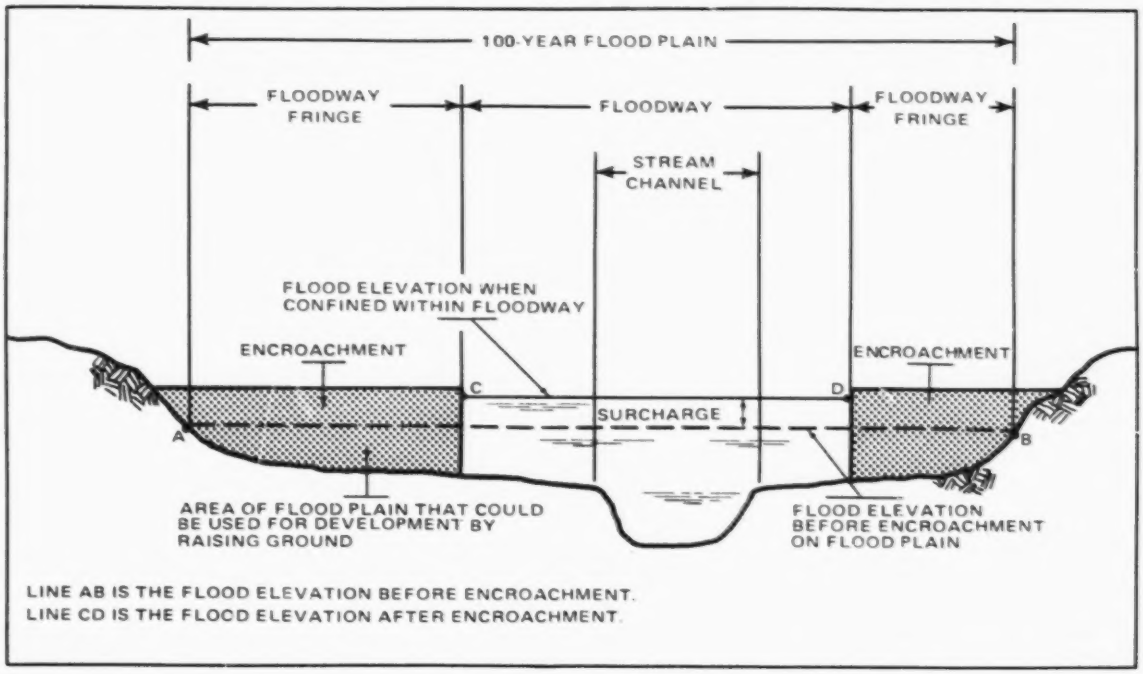

Figure 3. Floodway Schematic

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Emergency Management Agency has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the City of Nehalem.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WITH FLOODWAY	WITHOUT FLOODWAY (FEET NGVD)	DIFFERENCE[2]
Nehalem River							
A	0.45	1,030	15,570	4.8	9.9	9.6	0.3
B	1.05	620	13,190	5.6	10.5	10.1	0.4
C	2.01	720	14,430	5.1	11.7	11.1	0.6

[1] Miles Above Mouth [2] 1947 Adjustment

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEHALEM, OR
(TILLAMOOK CO.)

FLOODWAY DATA

NEHALEM RIVER

5.1 Reach Determination

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-year floods	Variation
2 to 7 feet	1.0 foot

One reach meeting the above criterion was required for the Nehalem River. The location of the reach is shown on the Flood Profiles.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Emergency Management Agency device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire incorporated area of the City of Nehalem was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A6: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factors.

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Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 2, "Flood Insurance Zone Data," summarizes the flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for the flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Nehalem is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Emergency Management Agency.

6.0 OTHER STUDIES

Plan-profile maps (Reference 10), which include high water profiles and flooded-area maps of Nehalem River, have been prepared by the U.S. Army Corps of Engineers. An engineering consultant is preparing the Tillamook County, Oregon, Flood Insurance Study (Reference 9), with the Nehalem River included in the study limits. Both studies agree with the Nehalem Flood Insurance Study.

This Flood Insurance Study is authoritative for purposes of the Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance & Mitigation Division, Federal Emergency Management Agency, Federal Regional Center, 130 228th Street, S.W., Bothell, WA 98011.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD[4])
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
NEHALEM RIVER Reach 1	0001	-2.8	-1.0	+1.5	030	A6	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot [4]1947 Adjustment

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEHALEM, OR
(TILLAMOOK CO.)

FLOOD INSURANCE ZONE DATA

NEHALEM RIVER

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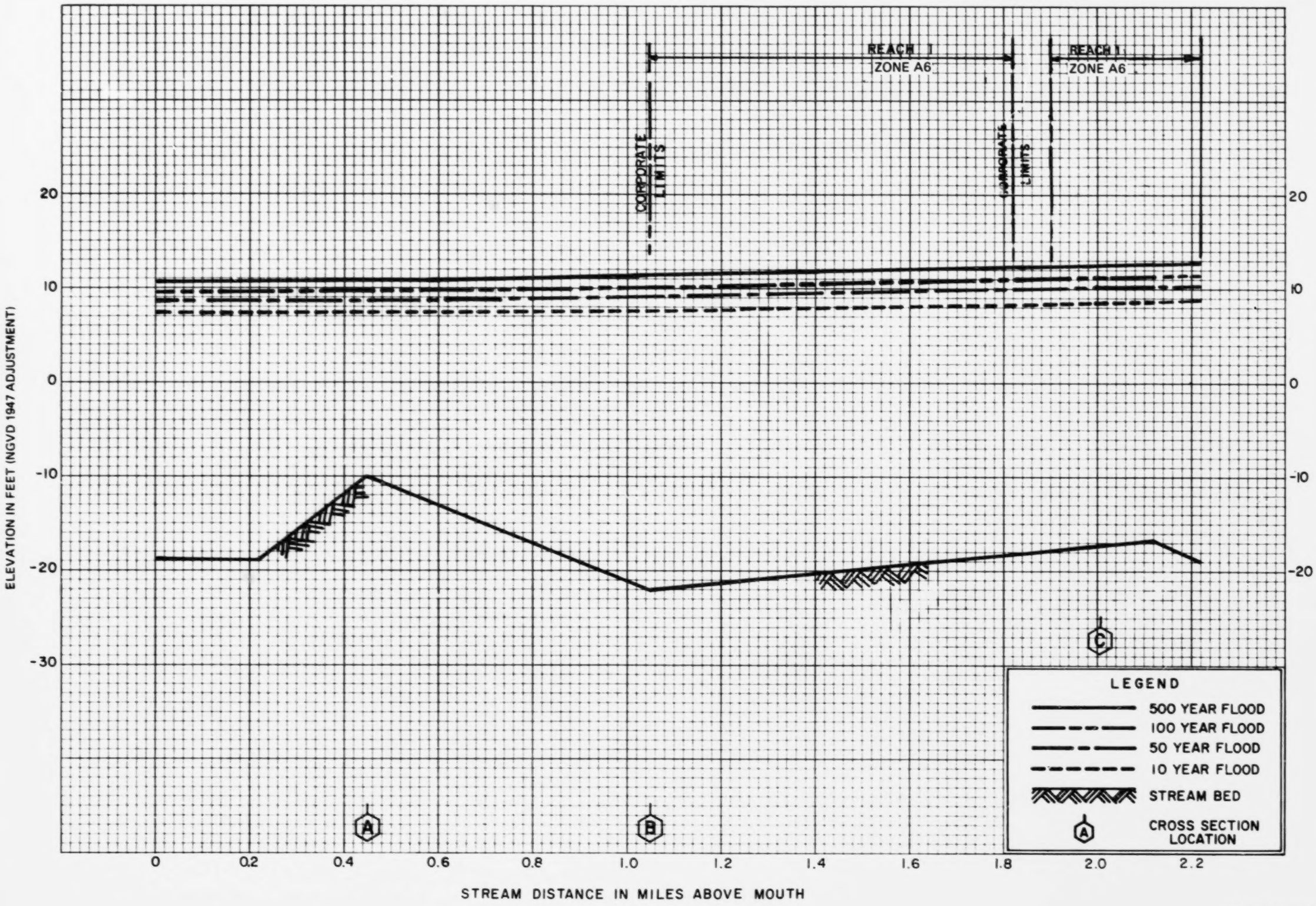

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FLOOD PROFILES

NEHALEM RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEHALEM, OR
(TILLAMOOK CO.)

01P